ENSO PREDICTABILITY STUDIES AT CIMS

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Relevant Publications/Manuscripts

Kleeman R., Y. Tang and A. M. Moore, 2003: The calculation of climatically relevant singular vectors in the presence of weather noise as applied to the ENSO problem, Journ. Atmos Sci, (in press).

Kleeman R., Y. Tang and A.M. Moore, 2003: On ENSO predictability, Journ. Atmos. Sci. (in preparation).

Kleeman R., 2002, Measuring dynamical prediction utility using relative entropy, Journ. Atmos. Sci. Vol 59 2057-2072.

Current Perspectives on Predictability for the Atmosphere and Ocean

Location: CIMS, NYU, 252 Mercer Street New York.

Dates: December 5 and 6, 2003.

Invited Speakers (All accepted):

- Olivier Talagrand
- Franco Molteni
- George Boer
- Robert Miller
- Benjamin Kirtman
- Jeffrey Anderson
- Gregory Eyink
- Brian Hunt
- Andrew Moore

CAOS Workshop Series 2003

CGCM Singular Vector Calculation

Traditional Calculation: Apply forward model to base and perturbed state vectors. Perturbation vectors must adequately span the desired set of singular vectors. Matrix with respect to the reduced space is used to calculate singular vectors.

Climatically relevant singular vectors: Atmospheric response to given ocean boundary conditions is non-unique hence forward results above are also non-unique. Problem solved by considering a set of "equally valid" forward calculations and using the ensemble mean to describe the climatic forward response.

Practical Aspects: Experience with hybrid/intermediate models shows that there is variation of SVs with the ENSO state but little variation with the annual cycle. Use this to construct ensembles with perturbations derived by a linear superposition of SV's calculated a various ENSO phases and amplitudes.

CGCM Singular Vector Results

Spatial Patterns: Most loading is in the equatorial region biased towards the east. Vectors calculated for the warm event precursor case show more loading in the west relative to vectors calculated for other times. Cold event precursor vectors were biased more towards the east. Overall there is not a great deal of variation of the loading which suggests that ensemble construction for arbitrary initial conditions should be feasible.

Growth rates of vectors: Over a six month period growth in the NINO3 region was around a factor of five which is consistent with results from intermediate and hybrid coupled models. The various different phases of the ENSO cycle showed considerable variation in growth with cold events showing the greatest growth.

Practical Aspects: The results show that a linear combination of the singular vectors calculated from various phases of ENSO and the neutral condition case should serve as a practical inexpensive method for ensemble generation for general forecast start dates.

Future Plans

- Carry out a series of interesting case studies for ensemble construction (e.g. March 1997, 1982, 1987, 1998) to check sensitivity of the system.
- Extend singular vectors to dynamic height and interior temperature sensitivity. This may be of use in future coupled model data assimilation experiments with the NSIPP model.
- Longer term: Verify the predictability results from the four simpler models carry over to the CGCM situation. The methodology developed in the simpler model cases enables an a priori accurate estimate of the reliability of a particular ENSO prediction.